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(54) Internal card type uninterruptible power system

(57) An internal card type uninterruptible power system 7 is to be used in combination with a computer 2 that is normally operated by line power. The system 7 includes a battery pack 9 which is charged when the line power is available and which is actuated to supply power to the computer 2 when the line power is cut off. The computer 2 is set to the real memory mode if it was operating in the virtual memory mode before the line power was cut off, and is then controlled so as to store system variables and memory data in a magnetic disk. The battery pack 9 is deactivated after storage of system variables and data has been completed. When the line power is restored, the computer 2 is controlled so as to retrieve the system variables and data from the magnetic disk and thereby restore the computer 2 to the previous operating state.
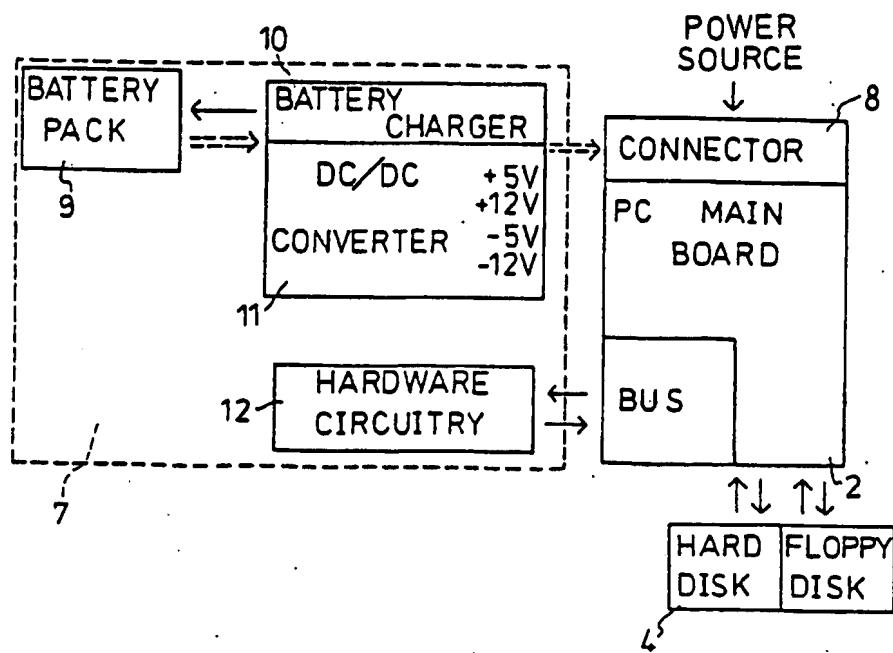

F I G. 2

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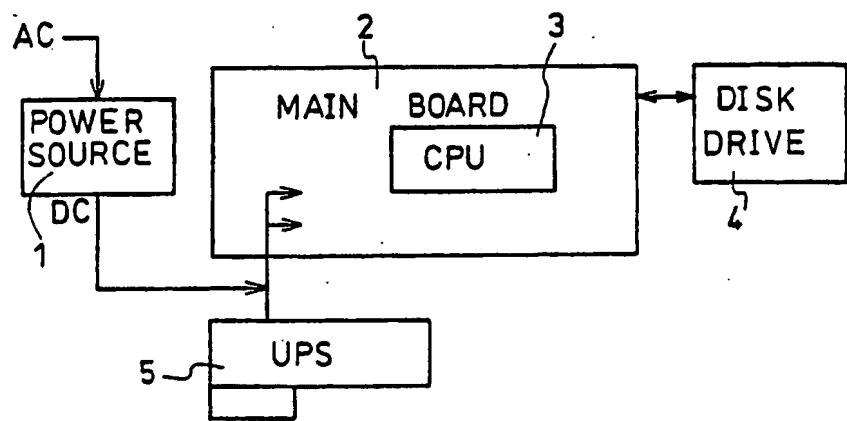
PRIOR ART
F I G.1

FIG. 2

FIG.3

FIG.4

FIG.5

FIG.6

FIG.7

FIG.8

START

a

b

NO

YES

c

d

e

f

g
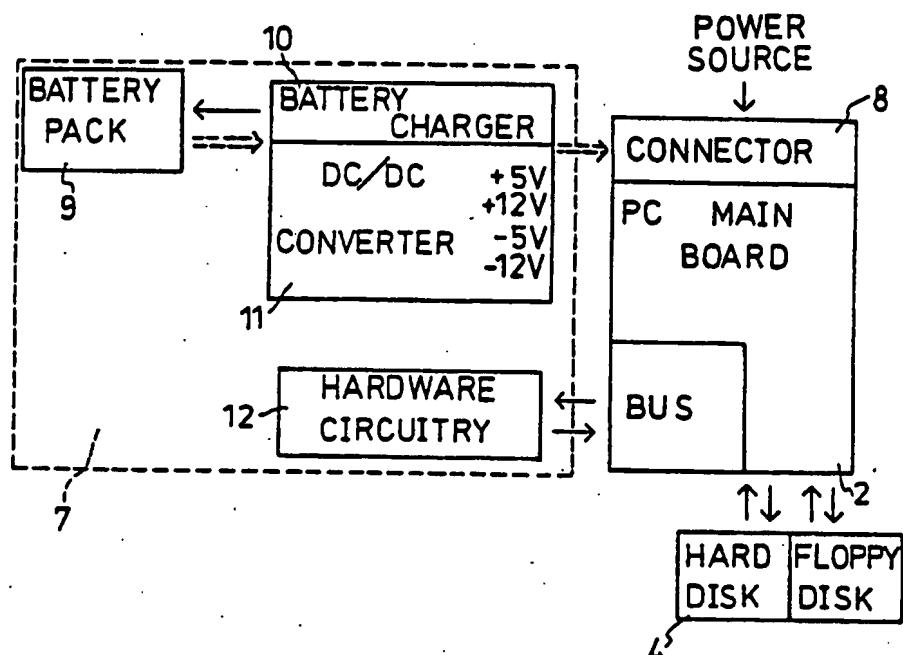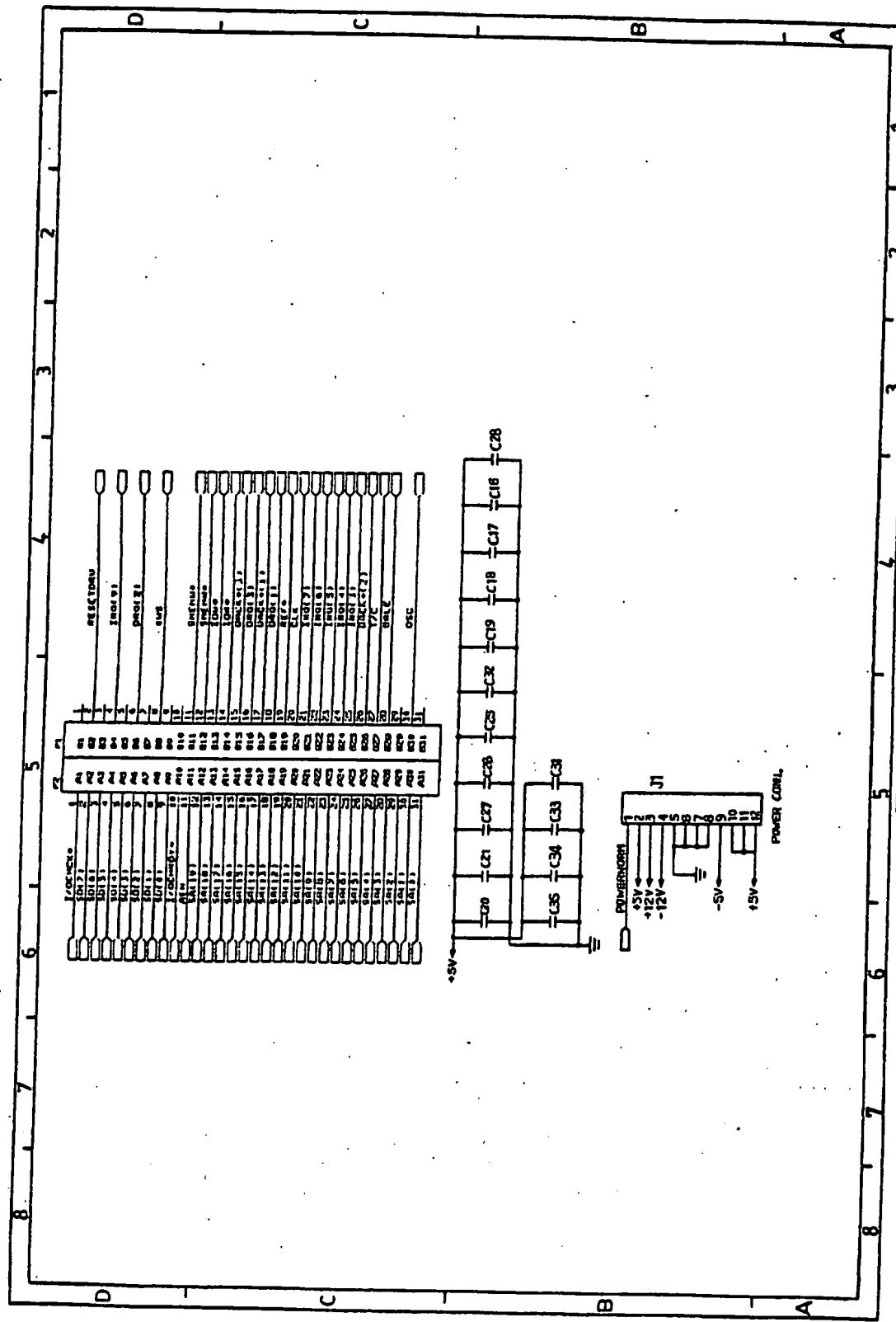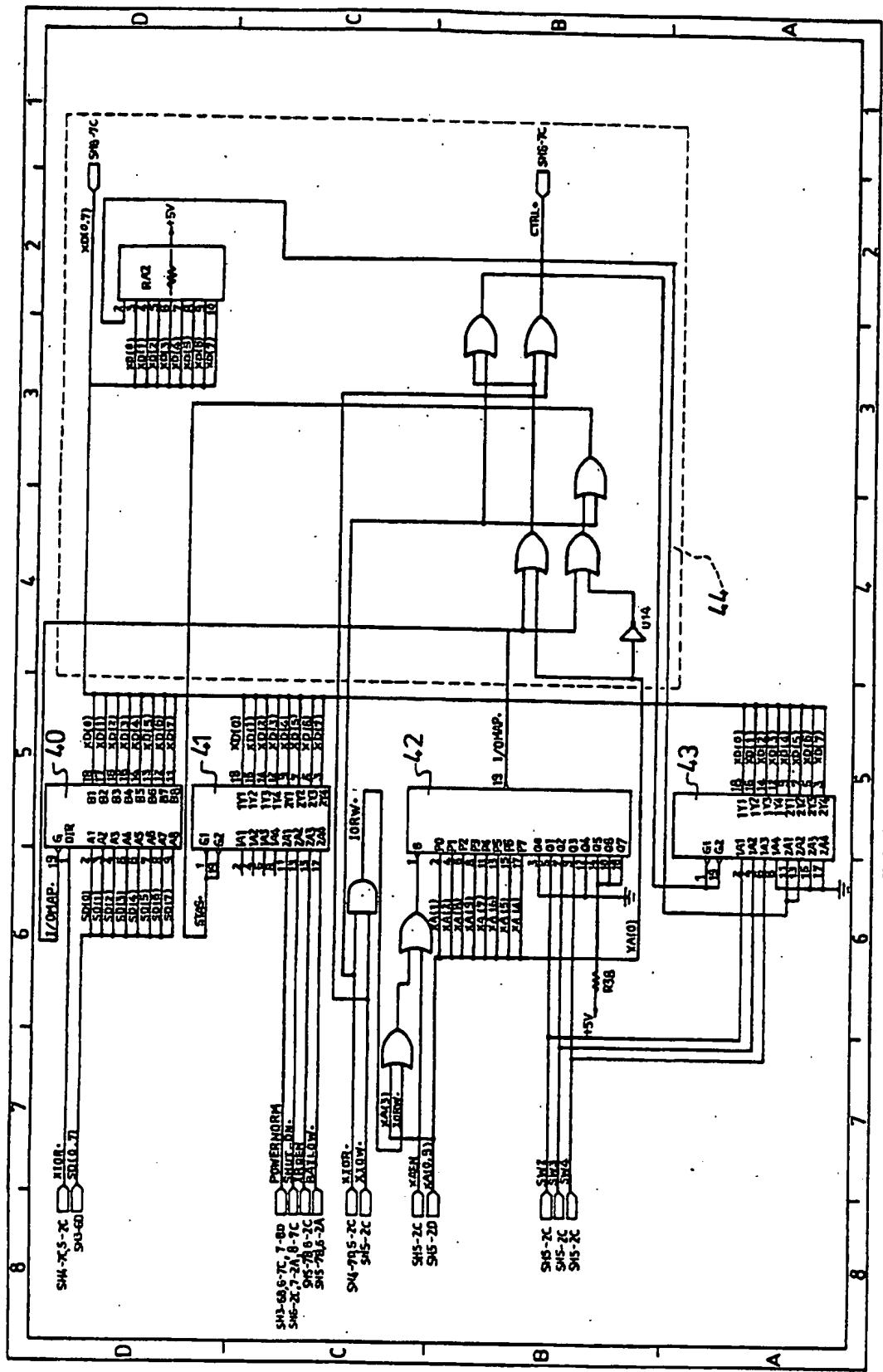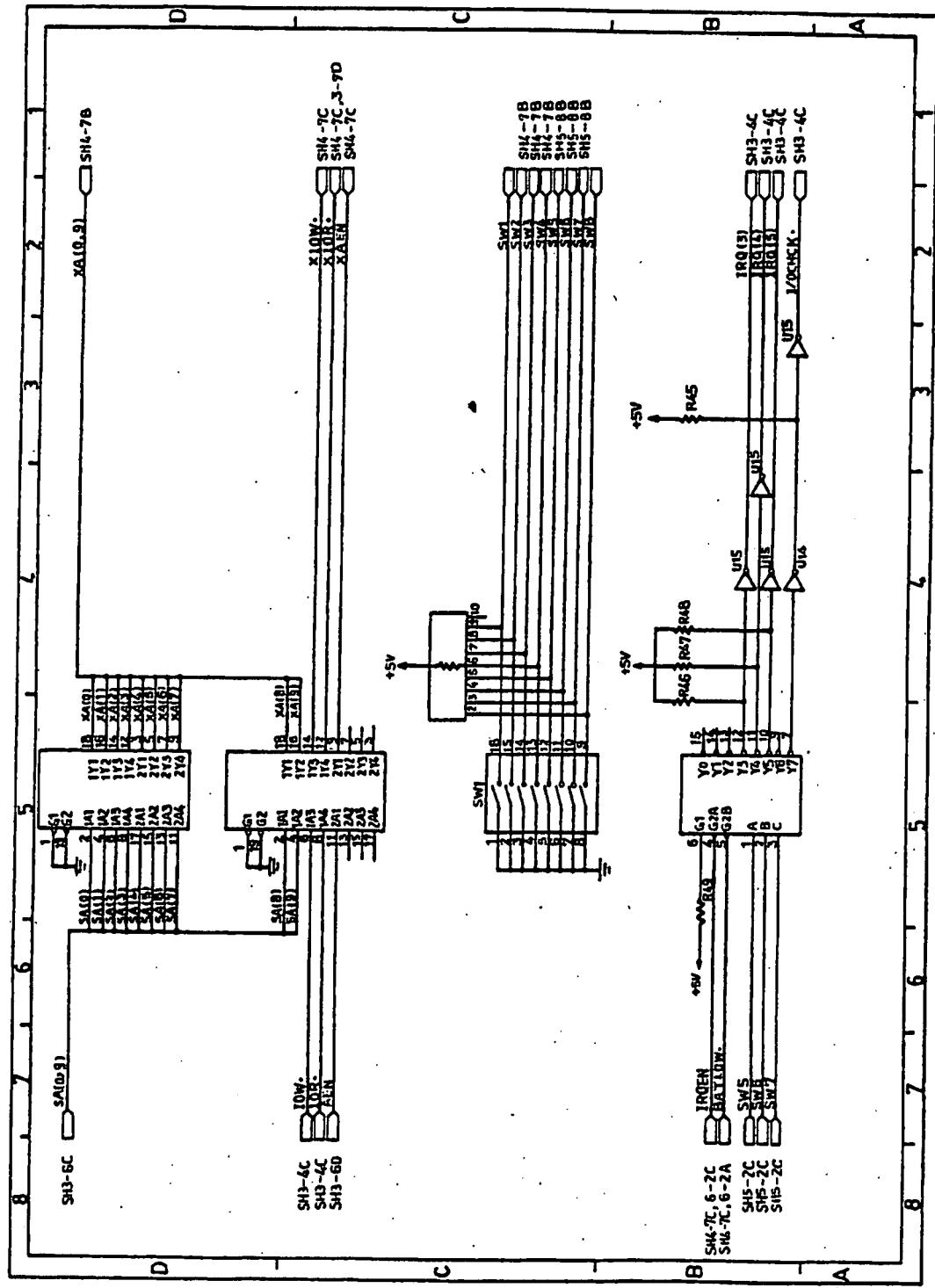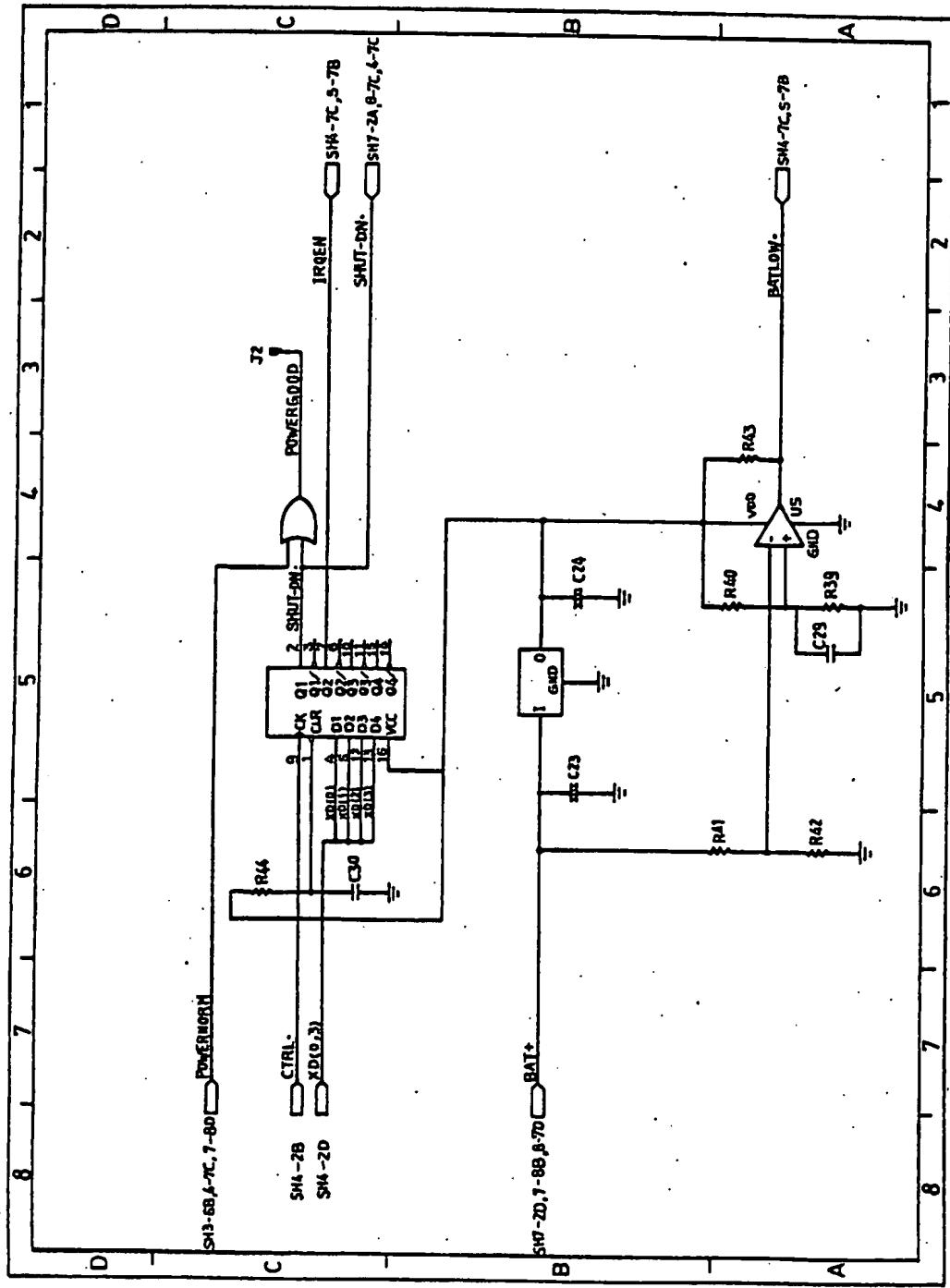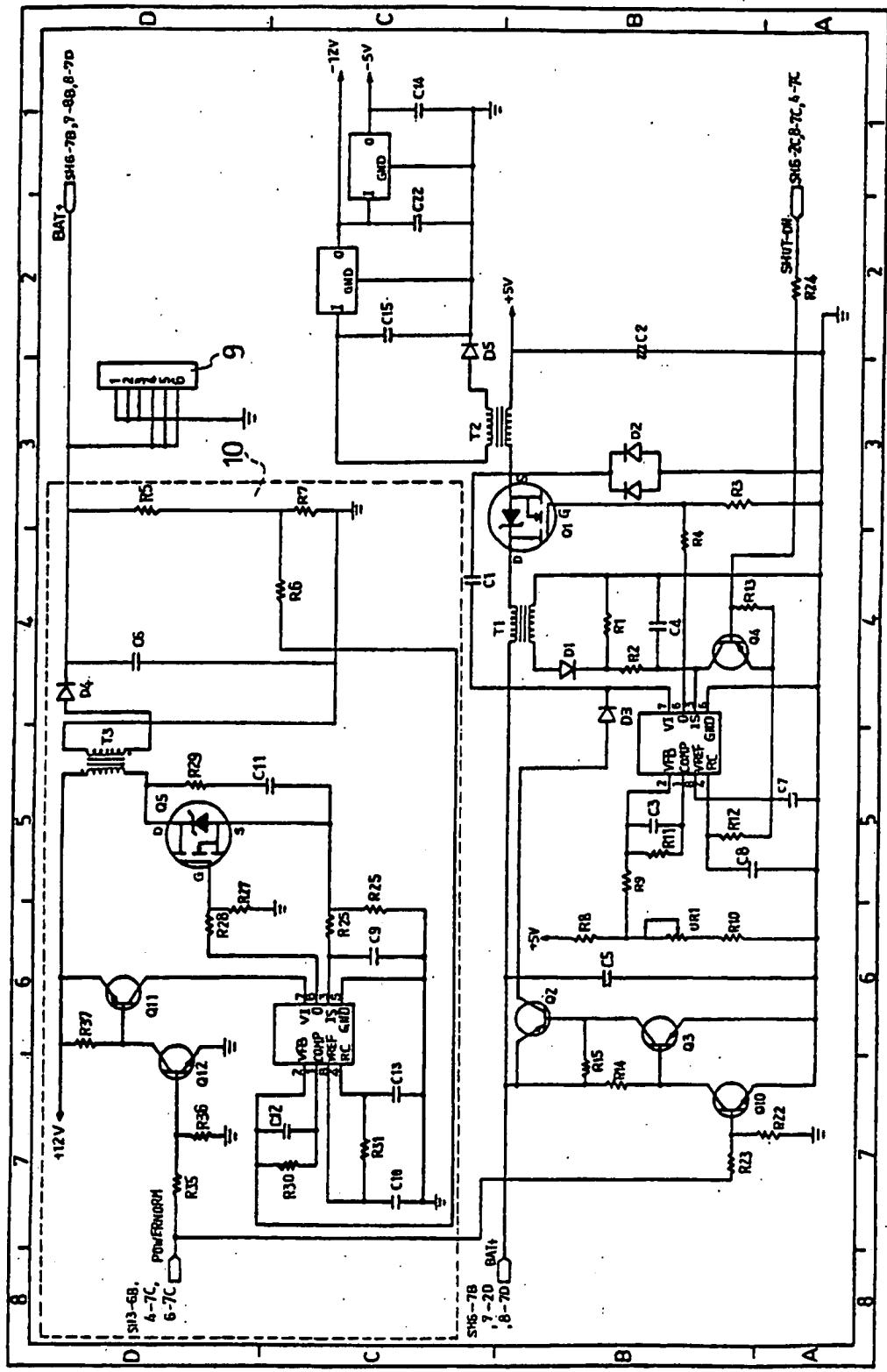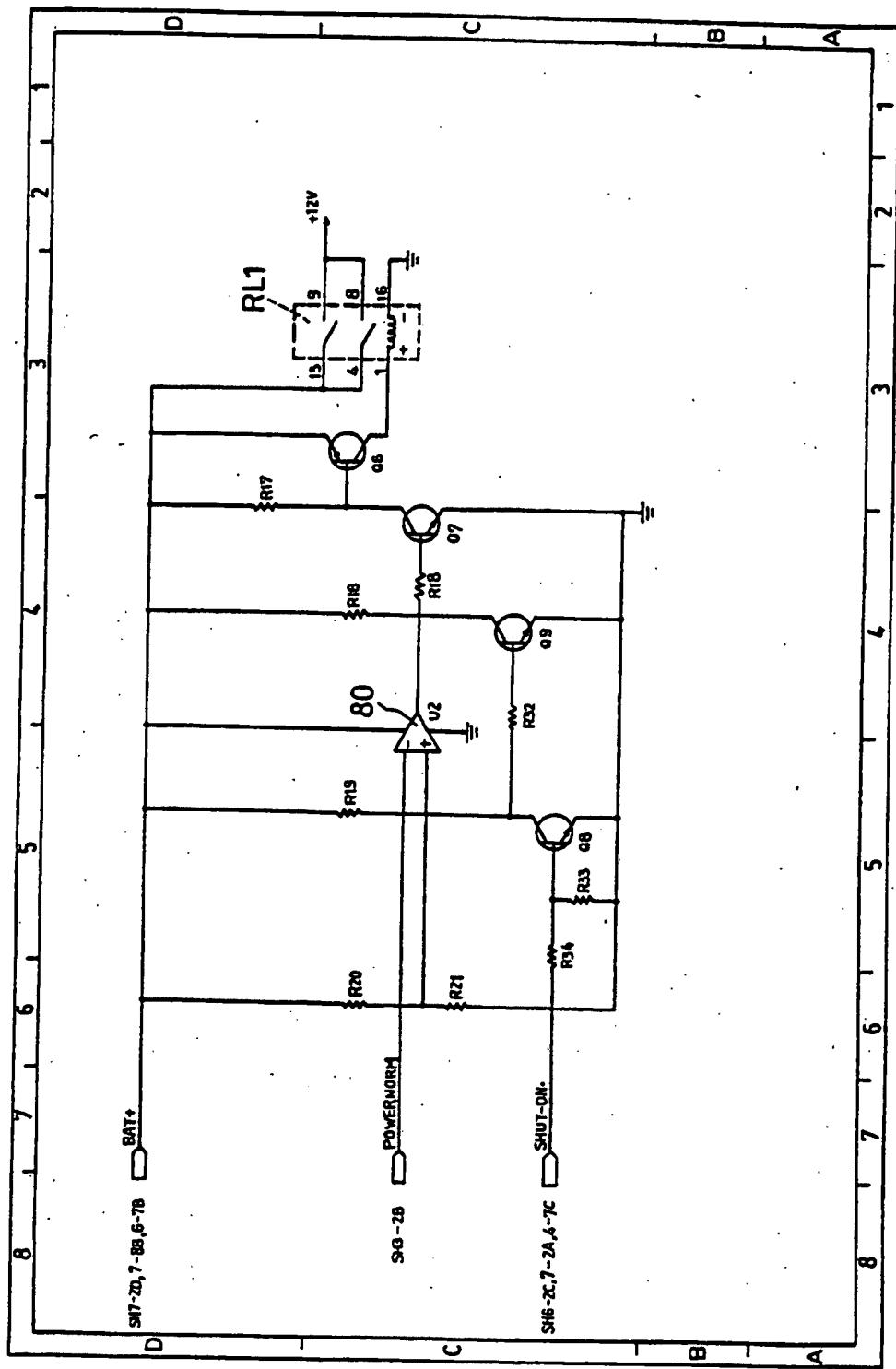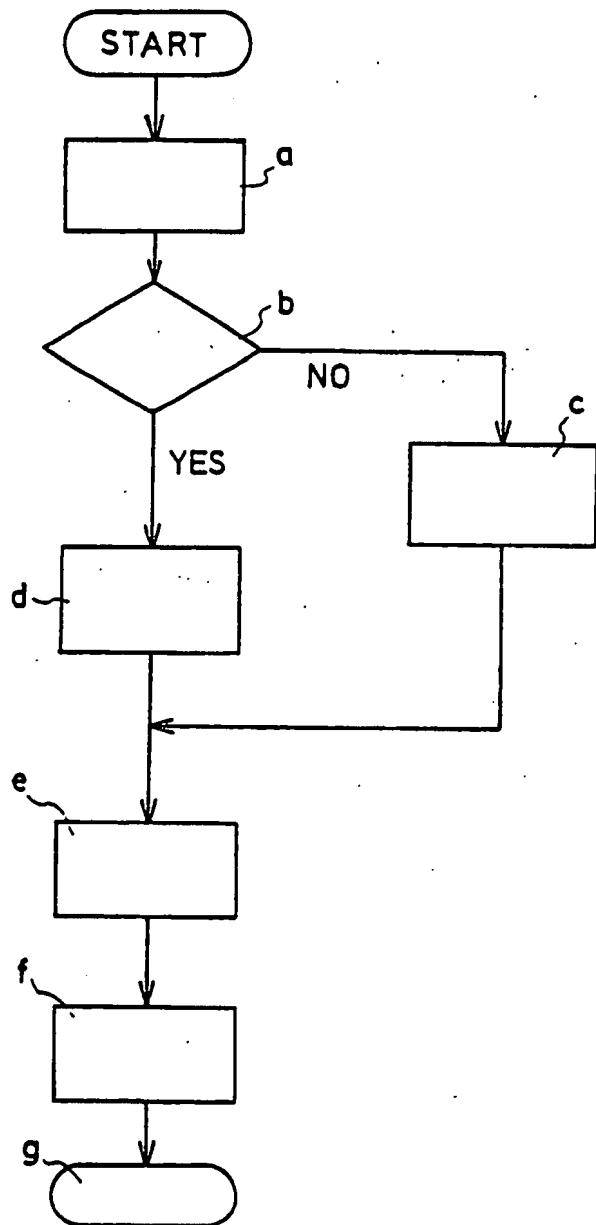
FIG. 9

INTERNAL CARD TYPE UNINTERRUPTIBLE POWER SYSTEM

This invention relates to an internal card type
uninterruptible power system (UPS), more particularly
to an internal card type UPS which can ensure that no
data will be lost should power interruption occur when
5   the central processing unit (such as the 80386) is
operating in the virtual memory mode.

Figure 1 is a schematic block diagram of a
conventional internal card type smart UPS when used
10   with an IBM PC/AT system. A power source (1) can
convert AC line voltage into a DC voltage. A main board
(2) has a central processing unit (3) provided thereon.
A disk drive (4) and the internal card type smart UPS
(5) are connected to the main board (2).

15   The operation of the above disclosed UPS card is as
follows: The UPS supplies back-up electric power to the
operating system when power interruption occurs. The
system variables and data in the memory unit are then
automatically stored on a magnetic disk. When power is
20   restored, the system variables and data are retrieved
from the magnetic disk and the operating system is
restored to its previous operating state (the state
before power interruption occurred).

The above procedure can be readily executed when the
25   system is operating in the real memory mode because
data can be easily stored and retrieved from any one of
the system data sources and because the system does not

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require any additional protective measures when it is operating in the real memory mode.

However, execution of the above procedure becomes complicated when the system is operating in the virtual

5   memory mode. There are several commands in the central processing unit which cannot be executed, and there are some special internal registers which cannot be accessed. Therefore, when the system is operating in the virtual memory mode, it is impossible to store the

10   internal states of the central processing unit completely and access all of the available memory space. Thus, when power interruption occurs, it is also impossible to store all of the system variables and data on a magnetic disk.

15   For example, the system is operating in the virtual memory mode when the Windows 3.0 software (developed by Microsoft Corporation) is in use. The resident driver routines and a conventional software are under the control of the windows system and cannot be directly

20   accessed from any of the system data sources. Thus, when power interruption occurs and when the real memory mode method is used to store the system variables and data, the work of the windows system is ruined, and the system cannot be restored to its previous operating

25   state.

Therefore, the main objective of the present invention is to provide an internal card type

uninterruptible power system (UPS) which can ensure
that no data will be lost should power interruption
occur when the system is operating in the virtual
memory mode.

5   Accordingly, the preferred embodiment of an internal
card type uninterruptible power system is to be used in
combination with a computer that is normally operated
by line power and comprises: a battery pack; a battery
charger means for charging the battery pack when the
10   line power is available; means for actuating the
battery pack to supply power to the computer when the
line power is cut off; means for generating an
interrupt command to the computer when the line power
is cut off; means for setting the computer to the real
15   memory mode if the computer was operating in the
virtual memory mode before the line power was cut off;
a first control means for controlling the computer to
store system variables and memory data on the magnetic
disk storage means; means for deactivating the battery
20   pack after storage of system variables and data has
been completed; and a second control means for
controlling the computer to retrieve system variables
and data from the magnetic disk storage means so as to
restore the computer to the previous operating state
25   when the line power is restored.

Other features and advantages of the present
invention will become apparent in the following

detailed description of the preferred embodiment with reference to the accompanying drawings, of which:

Figure 1 is a block diagram of a conventional UPS card when used with an IBM PC/AT system;

5   Figure 2 is a block diagram of the preferred embodiment of an internal card type UPS according to the present invention;

Figure 3 is a pin diagram of the preferred embodiment as shown in Figure 2;

10   Figure 4 is a schematic circuit diagram of a first circuit portion of the preferred embodiment used for converting the system from the virtual memory mode to the real memory mode;

Figure 5 is a schematic circuit diagram of a second
15   circuit portion of the preferred embodiment;

Figure 6 is a schematic circuit diagram of a third circuit portion of the preferred embodiment used for initiating the execution of resident driver routines;

Figure 7 is a schematic circuit diagram illustrating
20   a battery charger of the preferred embodiment;

Figure 8 is a schematic circuit diagram of another circuit portion for detecting power interruption; and

Figure 9 is a flowchart of a data storage procedure which is conducted by the preferred embodiment.

25   Referring to the block diagram shown in Figure 2, the preferred embodiment of an internal card type UPS (7) according to the present invention is connected to

a conventional computer main board (2) via a P8, P9 connector (8). The UPS card (7) comprises a battery pack (9), a battery charger (10), a DC/DC converter (11) and associated hardware circuitry (12).

The operation of the UPS card (7) is as follows:

(1) Referring to Figure 2 and to the upper half of Figure 7, when line power is available, a POWERNORM signal is supplied to the main board (2) via the P8, P9 connector (8). The battery charger (10) charges the battery pack (9) at this time.

(2) Referring to Figure 8, when the line power is cut off, a low voltage signal is detected at the negative input terminal of a comparator (80). The output to the positive input terminal of the comparator (80) is a high voltage signal, and thus, a positive voltage signal is generated at the output terminal of the comparator (80). The positive voltage signal causes the transistors (Q6, Q7) to conduct and actuate a relay (RL1). The normally open contacts of the relay (RL1) close so as to permit the system to draw electric power from the battery pack (9). The voltage output of the battery pack (9) is supplied to the DC/DC converter (11) so as to generate four stable DC voltages: +5 V, +12 V, -5 V, and -12 V. Generation of the +5 V, -5 V and -12 V voltages can be found in the lower half of Figure 7. The +12 V voltage can be obtained from the output of the circuit shown in Figure 8.

(3) Referring to the upper half of Figure 6, when
the line power is cut off, a POWERGOOD signal is at a
low logic state, thereby generating an Interrupt signal
to the computer main board (2) to initiate the
execution of the resident driver routines. Upon
detection that the line power was cut off, the resident
driver routines set up preparations for storing data.
The time which elapsed since the line power was cut off
is first counted. If the line power was restored within
a predetermined time period, the data storage procedure
is terminated. Therefore, continuous operation of the
system is ensured in the event of relatively short
power outages.

The data storage procedure is immediately executed
when the line power is not restored within the
predetermined time period. A flowchart of the data
storage procedure can be found in Figure 9. The
resident driver routines start to set request storage
flags [step (a)]. The control port (6) of the UPS card
(7) is then read to determine if the system is
operating in the real memory mode [step (b)]. If the
system is operating in the real memory mode, no special
protective measures are needed, and step (d) is then
executed. If the system is operating in the virtual
memory mode, operation of the central processing unit
(not shown) of the computer main board (2) is
interrupted, and the storage driving routine for the

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virtual memory mode is executed [step (c)]. The central processing unit is set from the virtual memory mode to the real memory mode before the storage of system data begins.

5   When storing of system data is initiated, the request storage flags are first inspected to see whether or not they have been reset [step (d)]. This indicates that the line power has been restored and that the system can be restored to its previous

10   operating state. If the request storage flags are not reset after a predetermined time period, the system storage operation is initiated [step (e)]. The request storage flags are reset during the execution of step (e). Afterwards, the system variables and data are

15   stored on a magnetic disk [step (f)]. The DC power source of the UPS card (7) is then shut off, thereby stopping the operation of the system. This permits conservation of the stored energy of the battery pack (9) in preparation for another power outage.

20   The system variables and data are stored on a magnetic disk. When the line power is restored, data in the magnetic disk is retrieved to restore the system to the previous operating state (that is, the state before the line power was cut off).

25   (4) In step (b) of the flowchart shown in Figure 9, it is necessary to distinguish if the system is operating in the real memory mode or in the virtual

memory mode. If the system is in the virtual memory mode, a converter circuit is necessary to convert the system from the virtual memory mode to the real memory mode.

5   It has been found that Address (170) of the central processing unit is used to indicate if the system is operating in the virtual memory mode or in the real memory mode. The content of Address (170) is 1 [170#1] if the system is in the virtual memory mode, and is 2

10   [170#2] if the system is in the real memory mode.

When power interruption occurs, the system may be in the real memory mode or in the virtual memory mode. Referring to Figure 4, four buffer means (40, 41, 42, 43) are connected to a comparator means (44). The

15   circuit shown in Figure 4 is not in operation should power interruption occur when the system is in the real memory mode. When the system is in the virtual memory mode, the signal [170#1] from the central processing unit is received by the comparator means (44), and the

20   signal [170#2] is sent to the central processing unit to convert the system from a virtual memory mode to the real memory mode. Thus, when power interruption occurs, the entire system variables and data can be safely stored even when the system is originally in the

25   virtual memory mode.

There are many methods available to interrupt the operation of the central processing unit. Aside from

the use of the I/O port, the use of "INT" commands or a RAM method can also be used to achieve the interrupt action. However, if the I/O port method is not used, conflict in the data sources can occur and thus affect the operation of the system. Conversion from the virtual memory mode to the real memory mode, however, can be easily and safely accomplished when the I/O port is used to generate the interrupt signal.

The following are other visible differences between the UPS card (7) of the present invention and conventional UPS cards:

1. The preferred embodiment is thinner and lighter and requires only a single AT bus slot. This is in contrast with conventional UPS cards which require 2-3 bus slots.

2. The DC/DC converter of the preferred embodiment has a conversion efficiency which is greater than 90%. This is in contrast with those of conventional UPS cards whose DC/DC conversion efficiency range from 50%-70%.

3. The AT bus interface circuit utilizes no memory chips (that is, only logic gates and flip-flops are used). Conversion from the virtual 86 memory mode can be easily executed so as to ensure proper data storage in the event of power interruption.

CLAIMS:

1. An internal card type uninterruptible power system
to be used in combination with a computer that is
normally operated by line power, said computer having a
magnetic disk storage means and said uninterruptible
power system comprising:

a battery pack;

a battery charger means for charging said battery
pack when the line power is available;

means for actuating said battery pack to supply
power to said computer when the line power is cut off;

means for generating an interrupt command to said
computer when the line power is cut off;

means for setting said computer to the real memory
mode if said computer is operating in the virtual
memory mode before the line power was cut off;

a first control means for controlling said computer
to store system variables and memory data in said
magnetic disk storage means;

means for deactivating said battery pack after
storage of system variables and data has been
completed; and

a second control means for controlling said computer
to retrieve system variables and data from said
magnetic disk storage means so as to restore said
computer to the previous operating state when the line
power is restored.

2. The internal card type uninterruptible power system as claimed in claim 1, further comprising means for activating said first control means only when the line power is not restored within a predetermined time period.

3. The internal card type uninterruptible power system as substantially described hereinbefore with reference to the accompanying Figures 2-9.

Patents Act 1977	Application number
Examiner's report to the Comptroller under Section 17 (The Search Report)	9125898.8

Relevant Technical fields	Search Examiner
(i) UK Cl (Edition K) G4A (AEP)	
	B G WESTERN
(ii) Int Cl (Edition 5) G06F - 1/30	
Databases (see over)	Date of Search
(i) UK Patent Office	
(ii) ONLINE DATABASE: WPI	3 MARCH 1992

Documents considered relevant following a search in respect of claims 1-3

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2147437 A Coppola (see whole document)	1-3
A	GB 0256815 A2 Universal Vectors (see whole document)	1-3

SF2(p)

Category	Identity of document and relevant passages	Relevant to claim(s)

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